SAT PREP

Basic Identities

Reciprocal Identities

$\csc u = \frac{1}{\sin u}$ $\sec u = \frac{1}{\cos u}$ $\cot u = \frac{1}{\tan u}$

$\sin u = \frac{1}{\csc u}$ $\cos u = \frac{1}{\sec u}$ $\tan u = \frac{1}{\cot u}$

Quotient Identities

$\tan u = \frac{\sin u}{\cos u}$ $\cot u = \frac{\cos u}{\sin u}$

Pythagorean Identities

$\cos^2 u + \sin^2 u = 1$ $1 + \tan^2 u = \sec^2 u$ $\cot^2 u + 1 = \csc^2 u$

Cofunction Identities

$\sin\left(\frac{\pi}{2} - u\right) = \cos u$ $\cos\left(\frac{\pi}{2} - u\right) = \sin u$

$\tan\left(\frac{\pi}{2} - u\right) = \cot u$ $\cot\left(\frac{\pi}{2} - u\right) = \tan u$

$\sec\left(\frac{\pi}{2} - u\right) = \csc u$ $\csc\left(\frac{\pi}{2} - u\right) = \sec u$

Sum and Difference Identities

$\sin(u+v) = \sin u \cos v + \cos u \sin v$

$\sin(u-v) = \sin u \cos v - \cos u \sin v$

$\cos(u+v) = \cos u \cos v - \sin u \sin v$

$\cos(u-v) = \cos u \cos v + \sin u \sin v$

$\tan(u+v) = \frac{\tan u + \tan v}{1 - \tan u \tan v}$

$\tan(u-v) = \frac{\tan u - \tan v}{1 + \tan u \tan v}$

Double Angle and Power Reducing Identities

$\sin(2u) = 2\sin u \cos u$

$$\cos(2u) = \cos^2 u - \sin^2 u$$
$$= 2\cos^2 u - 1$$
$$= 1 - 2\sin^2 u$$

$\tan(2u) = \frac{2\tan u}{1 - \tan^2 u}$

$\sin^2 u = \frac{1 - \cos(2u)}{2}$

$\cos^2 u = \frac{1 + \cos(2u)}{2}$

$\tan^2 u = \frac{1 - \cos(2u)}{1 + \cos(2u)}$

Verifying Identities

General Strategy:

1) You must have your basic identities memorized!
2) You should work with the more complicated looking side first. Remember that you can't move terms from one side to the other or multiply both sides by something.
3) Typically, you will want to add fractions together, simplify fractions so that they have monomials in the denominator, and/or factor when possible.
4) Look for opportunities to use trigonometric identities to get functions that are the same or that are paired up like sine and cosine, or tangent and secant, or cotangent and cosecant or that are paired up with the other side of the identity.
5) Another strategy might be to convert everything to sines and cosines.
6) You may want to multiply the numerators and denominators of fractions by something in order to create the difference of two squares like multiplying $(1 + \sin x)$ by $(1 - \sin x)$ to get $(1 - \sin^2 x)$ which equals $\cos^2 x$.
7) If nothing comes to mind just try something. It may lead somewhere or it might not but either way you will gain some insight about how to verify the identity.

Solving Trigonometric Equations

General Strategy:

1. Get the equation equal to zero
2. Convert all trigonometric functions into the same function by using identities or if that isn't possible, then factor the equation into factors where each has only one type of trigonometric function.
3. Set each factor equal to zero and solve for the trigonometric function.
4. Lastly identify which angles make each equation true.